

# **ARC WELDING**

## **SAFE SELECTION, OPERATION, AND MAINTENANCE PROCEDURES**

Welding equipment must be chosen for safe application to the work to be done.

Welding equipment must be installed safely.

Workmen designated to operate arc welding equipment must be properly instructed and qualified to operate such equipment.

Assurance of consideration of safety in design is obtainable by choosing apparatus complying with the Requirements for Electric Arc-Welding Apparatus, NEMA EW - 1 - 1962, National Electrical Manufacturers Association or the Safety Standard for Transformer-Type Arc-Welding Machines, ANSI C33.2 - 1956, Underwriters' Laboratories.

Standard machines for arc welding service must be designed and constructed to carry their rated load with rated temperature rises where the temperature of the cooling air does not exceed 40 deg. C. (104 deg. F.) and where the altitude does not exceed 3,300 feet (1,005.8 m), and must be suitable for operation in atmospheres containing gases, dust, and light rays produced by the welding arc.

Unusual service conditions may exist, and in such circumstances machines must be especially designed to safely meet the requirements of the service. These conditions include exposure to unusually corrosive fumes; steam or excessive humidity; excessive oil vapor flammable gases; abnormal vibration or shock; excessive dust; weather; unusual seacoast or shipboard conditions.

The following voltage limits must not be exceeded:

Alternating-current machines

- (A) Manual arc welding and cutting - 80 volts.
- (B) Automatic (machine or mechanized) arc welding and cutting - 100 volts.

Direct-current machines

- (A) Manual arc welding and cutting - 100 volts.
- (B) Automatic (machine or mechanized) arc welding and cutting - 100 volts.

When special welding and cutting processes require values of open circuit voltages higher than the above, means must be provided to prevent the operator from making accidental contact with the high voltage by adequate insulation or other means.

For a.c. welding under wet conditions or warm surroundings where perspiration is a factor, the use of reliable automatic controls for reducing no load voltage is recommended to reduce the shock hazard.

A controller integrally mounted in an electric motor driven welder must have capacity for carrying rated motor current, must be capable of making and interrupting stalled rotor current of the motor, and may serve as the running overcurrent device if provided with the number of overcurrent units as required.

On all types of arc welding machines, control apparatus must be enclosed except for the operating wheels, levers, or handles.

Input power terminals, tap change devices and live metal parts connected to input circuits must be completely enclosed and accessible only by means of tools.

Terminals for welding leads should be protected from accidental electrical contact by personnel or by metal objects i.e., vehicles, crane hooks, etc. Protection may be obtained by use of: Dead-front receptacles for plug connections- recessed openings with nonremovable hinged covers; heavy insulating sleeving or typing or other equivalent electrical and mechanical protection. If a welding lead terminal which is intended to be used exclusively for connection to the work is connected to the grounded enclosure, It must be done by a conductor at least two AWG sizes smaller than the grounding conductor and the terminal must be marked to indicate that it is grounded.

No connections for portable control devices such as push buttons to be carried by the operator must be connected to an a.c. circuit of higher than 120 volts. Exposed metal parts of portable control devices operating on circuits above 50 volts must be grounded by a grounding conductor in the control cable.

Auto transformers or a.c. reactors must not be used to draw welding current directly from any a.c. power source having a voltage exceeding 80 volts.

Installation including power supply must be in accordance with the electrical requirements.

The frame or case of the welding machine (except engine-driven machines must be grounded under the conditions and according to the methods prescribed in Subpart S of 29 CFR 1910.

Conduits containing electrical conductors must not be used for completing a work-lead circuit. Pipelines must not be used as a permanent part of a work-lead circuit, but may be used during construction, extension or repair providing current is not carried through threaded joints, flanged bolted joints, or caulked joints and that special precautions are used to avoid sparking at connection of the work-lead cable.

Chains, wire ropes, cranes, hoists, and elevators must not be used to carry welding current.

Where a structure, conveyor, or fixture is regularly employed as a welding current return circuit, joints must be bonded or provided with adequate current collecting devices.

All ground connections must be checked to determine that they are mechanically strong and electrically adequate for the required current.

A disconnecting switch or controller must be provided at or near each welding machine which is not equipped with such a switch or controller mounted as an integral part of the machine. The switch must be in accordance with electrical requirements. Overcurrent protection must be provided as specified in Subpart S of 29 CFR 191.0. A disconnect switch with overload protection or equivalent disconnect and protection means must be provided for each outlet intended for connection to a portable welding machine.

For individual welding machines, the rated current-carrying capacity of the supply conductors must be not less than the rated primary current of the welding machines.

For groups of welding machines, the rated current-carrying capacity of conductors may be less than the sum of the rated primary currents of the welding machines supplied. The conductor rating must be determined in each case according to the machine loading based on the use to be made of each welding machine and the allowance permissible in the event that all the welding machines supplied by the conductors will not be in use at the same time.

In operations involving several welders on one structure, d.c. welding process requirements may require the use of both polarities-, or supply circuit limitations for a.c. welding may require distribution of machines among the phases of the supply circuit. In such cases no load voltages between electrode holders will be 2 times normal in d.c. or 1, 1.41, 1.73, or 2 times normal on a.c. machines. Similar voltage differences will exist if both a.c. and d.c. welding are done on the same structure.

All d.c. machines must be connected with the same polarity.

All a.c. machines must be connected to the same phase of the supply circuit and with

the same instantaneous polarity.

Workmen assigned to operate or maintain arc welding equipment must be acquainted with the requirements of 1910. 253 and with 1910.252 (a), (b), and (c); if doing gas-shielded arc welding, also Recommended Safe Practices for Gas-Shielded Arc Welding, A6.1 - 1966, American Welding Society.

Before starting operations all connections to the machine must be checked to make certain they are properly made. The work lead must be firmly attached to the work; magnetic work clamps must be freed from adherent metal particles of spatter on contact surfaces. Coiled welding cable must be spread out before use to avoid serious overheating and damage to Insulation.

Grounding of the welding machine frame must be checked. Special attention must be given to safety ground connections of portable machines.

There must be no leaks of cooling water, shielding gas or engine fuel.

The proper switching equipment for shutting down each machine must be provided.

Printed rules and instructions covering operation of equipment supplied by the manufacturers must be strictly followed.

Electrode holders when not in use must be so placed that they cannot make electrical contact with persons, conducting objects, fuel or compressed gas tanks.

Cables with splices within 10 feet (3 m) of the holder must not be used. The welder should not coil or loop welding electrode cable around parts of his body.

The operator should report any equipment defect or safety hazard to his supervisor and the use of the equipment must be discontinued until its safety has been assured. Repairs must be made only by qualified personnel.

Machines which have become wet must be thoroughly dried and tested before being used.

Cables with damaged insulation or exposed bare conductors must be replaced. Joining lengths of work and electrode cables must be done by the use of connecting means specifically intended for the purpose. The connecting means must have insulation adequate for the service conditions.

